DISSERTATION ON

CAUDAL EPIDURAL ANALGESIA IN CHILDREN - COMPARISON OF 0.25% BUPIVACAINE WITH 0.25% BUPIVACAINE AND MORPHINE

MD DEGREE EXAMINATION

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CERTIFICATE

This is to certify that this dissertation entitled 'Caudal epidural analgesia in children – comparison of 0.25% Bupivacaine with 0.25% Bupivacaine and Morphine' is a bonafide record of work done by **Dr.K.SATHYA NARAYAN** under my guidance and supervision in the Department of Anesthesiology, Thanjavur Medical College and Hospital, Thanjavur – 613004, during the period of his postgraduate study for M.D. (Branch X), Anesthesiology from 2003 to 2006.

DR.AL.MEENAKSHISUNDARAM, MD., DA.,
PROFESSOR,
DEPARTMENT OF ANESTHESIOLOGY,
MEDICAL COLLEGE.

DR.R.MUTHUKUMARAN, MD., DA.,
PROFESSOR & HEAD,
DEPARTMENT OF ANESTHESIOLOGY, THANJAVUR
THANJAVUR MEDICAL COLLEGE.

THE DEAN

THANJAVUR MEDICAL COLLEGE,

THANJAVUR.

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1.Introduction

1. INTRODUCTION

Pain has become the fifth vital sign and is now a critical focus of the patient. The relief of pain has always been part of anesthesiologist's role in the most immediate postoperative period and extending beyond postanesthesia care unit. There is also increasing evidence that optimal pain management can impact outcome beyond the intra operative period.

Alleviation of postoperative pain may continue to improve clinical outcomes, hasten recovery, facilitate early mobilization and return to daily living. Regional analgesic techniques are the corner stones of postoperative analgesia as they provide intense dynamic pain relief.

Awareness and treatment of postoperative pain in children has improved to significant proportions. Children suffer postoperative pain in the same way as adults. Factors such as fever, anxiety, coping style and lack of social support can exaggerate physical pain further.

PAIN is a perception that is far more complex than simple transmission of information along nerve pathways to brain. It consists of component of transmission of pain sensation, a component of processing and evaluation by higher centers of brain and a

component of reaction to sensation.

The response to PAIN in children consists of behavioural, psychological and social changes. The cognitive ability, child's trust of caregivers and previous painful experiences will influence their response. The manner in which the family reacts to the stress of a child's pain will also influence the response to pain. Appropriate pain management is of great importance when dealing with children, because the way the child is treated may influence the way he/she deals with pain for rest of his /her life.

Untreated Pain can lead to physiologic complications, psychological distress, personality changes in developing children, family disruption, interruption of hospital routine and prolongation of hospitalisation with resultant increased costs. In addition social withdrawal, temper tantrums and demanding behaviour are also seen in these children. Children withdraw from their environment and stop participating in interpersonal interactions.

Administration of regional analgesia with Local Anesthetics or combination of Local Anesthetics and opioid mixture remains a cornerstone of postoperative analgesia in children. This study is designed to evaluate and compare the duration of analgesia and side effects of 0.25% bupivacaine and combination of 0.25% bupivacaine and morphine (0.03 mg/kg) given through caudal epidural route in children undergoing lower abdominal general surgical procedures.

2.Aim of the study

2. AIM OF THE STUDY

To compare the duration of analgesia and side effects of a combination of 0.25% bupivacaine and low dose morphine (0.03 mg/kg) with 0.25% bupivacaine alone injected into caudal space for relief of postoperative pain in children undergoing lower abdominal general surgical procedures.

3. Anatomical Consideration of Caudal Epidural Space

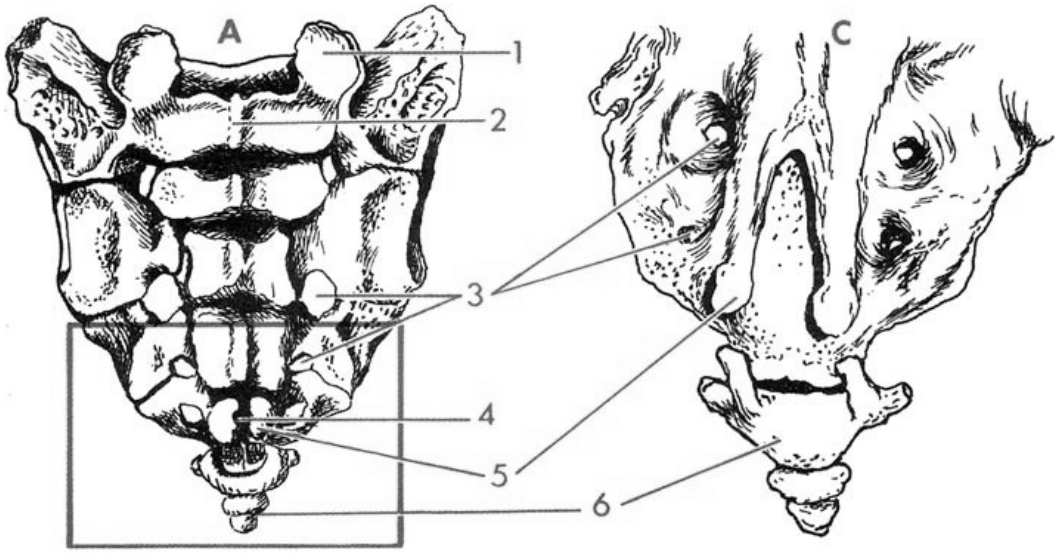
3. ANATOMICAL CONSIDERATION OF CAUDAL EPIDURAL SPACE

SACRAL HIATUS

It is a bone defect, triangular in shape and situated at the lower end of the sacrum just above the sacrococcygeal junction. The hiatus results from non-fusion of the 5th sacral and at times 4th sacral vertebral arches. It appears as an inverted U or V; the large bony processes on each side are called the cornua. The sacral cornua are in fact the embryological remains of the inferior articular processes of the 5th sacral vertebrae. The hiatus is covered by the sacrococcygeal membrane formed by the superficial and deep fibres of sacrococcygeal ligaments and is attached laterally to sacral cornua.

The sacrococcygeal membrane is actually a continuation of ligamentum flavum. The sacrum is cartilaginous in neonates and infants**,** and it's ossification is completed between 25 to 30 years of age. At increasing age, the sacrococcygeal angle increases, thus closing sacral hiatus and therefore making caudal anesthetic more difficult. This is especially true after the age of 7 years **[1]**.

CAUDAL ANATOMY



1. Superior articular process
2. Sacral crest
3. Posterior sacral foramens
4. Sacral hiatus
5. Sacral crest
6. Coccyx

SACRAL CANAL AND THE CAUDAL EPIDURAL SPACE

The sacral canal is a caudal extension of the spinal canal. The spinal canal contains the last spinal nerve roots, which forms the cauda equina and also the filum terminale that anchors spinal cord to coccyx and sacrococcygeal ligament. The dural sac projects upto S3 - S4 level at birth, reaching the adult level of S2 during second year of life.

The caudal epidural space in a neonate is filled with epidural fat, which has a gelatinous spongy appearance with distinct spaces between the fat globules and very few connective tissue fibers. This facilitates uniform and rapid spread of the local anesthetic solutions. Between 6 to 7 years of age, the epidural fat gets denser and is surrounded by fibrous strands, thus reducing uniform spread of local anesthetic solutions. The epidural space is richly vascularised and the veins are without valves; thus an inadvertent intravascular injection can lead to instantaneous systemic toxicity.

Pharmocology Of

Bupivacaine

4. PHARMOCOLOGY OF BUPIVACAINE

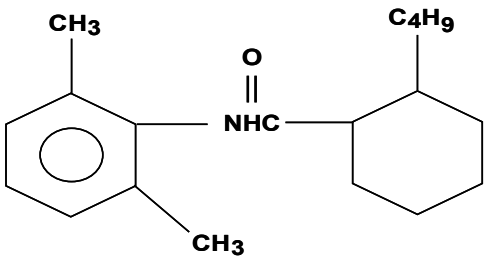
The pharmacology of local anesthetics are generally the same in children as it is in adults. There are differences like

1. Increased volume of distribution
2. Decreased protein binding of local anesthetics
3. Enzyme immaturity

Decreased protein binding of local anesthetics and enzyme immaturity can lead to systemic toxicity of Local Anesthetics with high protein affinity.

Caudal injections of bupivacaine are now routinely used in children undergoing lower abdominal and urogenital surgery to provide intraoperative and postoperative analgesia. **[2] [3]**

BUPIVACAINE



It is an amide local anesthetic characterised as pipecoloxylidides. Addition of a butyl group to the piperidine nitrogen of mepivacaine results in Bupivacaine. It is a chiral drug because of possession of asymmetric carbon atom.

It was first synthesized in Sweden by **EKENSTAM** and his colleagues in 1957 and used clinically by **L.J.TELIVUO** in 1963. It's molecular weight is 288.

MECHANISM OF ACTION

It prevents transmission of nerve impulses by inhibiting passage of sodium ions through ion selective sodium channels in nerve membranes. They do not alter the resting transmembrane potential or threshold potential.

PHARMACOKINETICS

It is a weak base that has Pk value above physiologic PH. At PH 7.4 only 15% exists in nonionised form. Absorption depends on the site of injection, dosage and use of epinephrine. Lung is capable of extracting bupivacaine from circulation, which will limit concentration of drug that reaches systemic circulation. This first pass pulmonary extraction is dose dependent suggesting that it becomes saturated rapidly.

Pk : 8.1

Protein Binding	:	95%
Lipid solubility	:	28
Volume of distribution	:	73 liter
Clearance of drug from plasma	:	0.471 lit/min
Elimination half life	:	210 min (3.5 hours)
$t_{½}\alpha$	:	2.7 min
$t_{½}\beta$	:	28 min

METABOLISM

Slowest metabolism among amide local anesthetics. It undergoes aromatic hydroxylation, N- dealkylation, amide hydrolysis and conjugation. Only the N-desbutyl bupivacaine has been measured in blood or urine after epidural or spinal anesthesia. Alpha-1 acid glycoprotein is the most important protein-binding site of bupivacaine.

SIDE EFFECTS

Bupivacaine is more cardiotoxic than equieffective doses of Lignocaine. This is manifested by severe ventricular arrhythmias and myocardial depression. Bupivacaine blocks cardiac Na+ channels rapidly during systole and dissociates more slowly during

diastole, so that a significant fraction of Na+ channels remain blocked at the end of the diastole **[4]**. Thus the block by Bupivacaine is cumulative and substantially greater.

CLINICAL USE

Onset of anesthesia and duration of action are long. It's tendency to provide more sensory than motor block has made it popular for providing postoperative analgesia. It is used mainly for Infiltration anesthesia, field block anesthesia, nerve block anesthesia, spinal anesthesia and epidural anesthesia.

RECOMMENDED DOSES

The suggested dose of bupivacaine without epinephrine is 2.5-mg/Kg body weight. The recommended dose of bupivacaine with epinephrine is 3-mg/Kg body weight.

TOXIC PLASMA CONCENTRATION THRESHOLD

The plasma concentration threshold that is considered to be toxic is 1.6 - 2 micro grams / ml.

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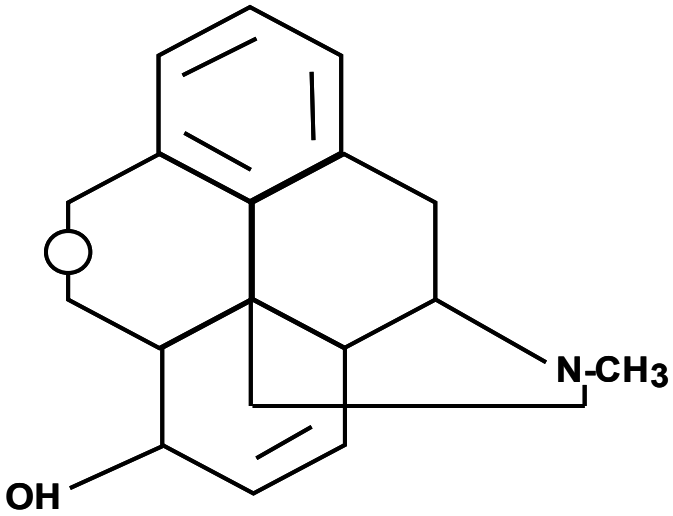
5.Pharmocology Of Morphine

5.MORPHINE

Morphine is the prototype opioid agonist. Its pharmacological actions are due to binding to specific opioid receptors mu1 (μ_1) and mu2 (μ_2). It is the principal phenanthrene alkaloid present in opium.



MECHANISM OF ACTION

The analgesic action of morphine administered via the intrathecal / epidural route results, atleast partly, from binding to μ receptors in the gray matter of the dorsal horn of spinal cord.

These receptors are abundant at the level of substantia gelatinosa of **Rolando [5].** At cellular level, it blocks the calcium channels. They have both presynaptic and

postsynaptic action. At the presynaptic level they act on the Aδ and C afferent nerve fibres inhibiting the release of substance P, which is the pain mediator at the spinal level **[6].**

Intrathecal and epidural opioids specifically decrease the electrical activity in the ascending neurons, which are activated by stimulation of the primary afferent fibres. Presynaptic inhibition is mediated through the GABAergic mechanism. Postsynaptic inhibition is mediated through glycinergic mechanism.

Analgesic effect is also due to supraspinal effect that involves descending inhibitory pathways.

PHARMACOKINETICS

Morphine is well absorbed after intramuscular administration. The onset of effect takes 15-30 minutes. The peak effect occurs at 45-90 minutes. If administered intravenously, peak effect occurs at 15-30 minutes.

Plasma morphine concentrations do not closely correlate with pharmacologic activity due to delay in penetration of blood brain barrier.

< 0.1% of morphine administered intravenously enters CNS at the time of peak plasma concentration. The causes are poor lipid solubility, high degree of ionisation at

physiologic PH and rapid conjugation with glucuronic acid.

MORPHINE

Pk	Percent nonionised (PH 7.4)	Protein Binding	Clearance (ml/ min)	Elimination half time (hrs)	Volume of distribution (lit)
7.9	**23%**	**35%**	**1,050**	**1.7-3.3**	**224**

METABOLISM

The principal pathway is conjugation with glucoronic acid in hepatic and extrahepatic sites, especially the kidneys.

75% - 85% appears as morphine 3 glucoronide

5 - 10% as morphine 6 glucoronide

5% demethylated to normorphine and a small amount as codeine

1% - 2% recovered unchanged in urine

Metabolites are eliminated in urine, with only 7% - 10% undergoing billiary excretion.

SIDE EFFECTS

CARDIOVASCULAR SYSTEM

Morphine results in decreased sympathetic nervous system tone of peripheral veins leading to decreased venous return. It results in decreased cardiac output and blood pressure. Braycardia may result due to central action. Morphine also leads to hypotension due to histamine release.

RESPIRATORY SYSTEM

Dose dependent depression of ventilation through mu2 receptors by direct depressant effect on brainstem ventilation centers.

BILIARY TRACT

It results in spasm of biliary smooth muscle.

GASTRO INTESTINAL SYSTEM

It leads to complications like delayed gastric emptying and constipation. Nausea and vomiting results due to direct stimulation of chemoreceptor trigger zone in the floor of fourth ventricle.

GENITO URINARY SYSTEM

Morphine leads to urinary retention due to increased tone of vesical sphincter.

EPIDURAL MORPHINE

The opioids, whether administered intrathecally or epidurally have the same mechanism

of action. The analgesic action of morphine administered through epidural route results, atleast partly, from binding to receptors situated principally in the gray matter of the dorsal horn of spinal cord. These are abundant at the level of substantia gelatinosa of Rolando. These are the μ,δ and κ type of opioid receptors.

The rate of elimination of opioids from the cerebrospinal fluid depends on the physicochemical properties of the opioids, especially their lipid solubility. Morphine is less lipophilic and hence less bound to the lipidic structures of the spinalcord compared to more lipophilic opioids such as fentanyl. Thus the concentration of morphine in the CSF decreases slower.

Similarly, this difference in lipid solubility explains its rostral spread, which is responsible for the secondary central effects, particularly at the medullary respiratory center in the form of delayed respiratory depression. Thus morphine reaches structures in the floor of the fourth ventricle after 6 hours of its intrathecal administration **[7].**

There is no correlation between degree of analgesia achieved following administration of opioids by intrathecal or epidural route and their plasma concentration in both adults and children, especially when low doses are administered **[8]**.

The vascular absorption of opioids administered by lumbar or caudal epidural route is similar to that following intramuscular administration. Dural permeability to opioids depends mainly on molecular weight not on its lipid solubility. Following epidural administration the CSF concentration of morphine reaches 50 to 250 times it's plasma concentration, determined at any time from 15th Minute to the 20th hour following administration **[9]** and **[10]**.

SIDE EFFECTS

RESPIRATORY DEPRESSION

It occurs as frequently as after intrathecal opioid administration. Similar to analgesic effect, this effect is also dose dependent. Respiratory depression induced by opioid is of two types, early and delayed. Early onset occurs due to intravascular absorption of opioid and due to its redistribution in the cerebrospinal fluid. Delayed respiratory depression is due to rostral spread of poorly lipophilic opioid that persists in the CSF.

Following epidural administration of morphine, the risk of delayed respiratory depression is maximum between 3rd and the 6^{th} hour and persists up to 22 hours after administration.

Somnolence, decrease in respiratory rate and intense pruritus are the clinical signs indicating impending respiratory depression. If respiratory depression occurs naloxone should be administered as repeated boluses (10 micg/kg) initially and then by continuous intravenous drip (5 micg/kg/hr) over 12 to 24 hours.

The nonrespiratory side effects of opioid, though not dangerous give rise to considerable morbidity.

PRURITUS

Generally limited to face (perioral and nasal) is rarely troublesome. It is probably of central origin, as it is not relieved by antihistaminics but by naloxone. If generalized, it could be a warning sign of respiratory depression.

NAUSEA AND VOMITING

It is troublesome in the postoperative period. This can occur irrespective of the route of administration of opioid. Nausea and vomiting occurs in 20-50% of cases during epidural or intrathecal administration of opioids **[11]**.

URINARY RETENTION

The incidence following opioid administration is frequent, about 27- 46%. Opioids cause retention by relaxing detrusor muscle of the bladder. This effect is essentially independent of the dose and can be alleviated by use of small dose of naloxone (1-2 micg/Kg).

CENTRAL NERVOUS SYSTEM

Somnolence and sedation are also frequent. Excessive sedation should be considered as

an indicator of impending respiratory depression.

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6.Calculation Of The Volume Of Local Anesthetic For Caudal Anesthesia

6. CALCULATION OF THE VOLUME OF LOCAL ANESTHETIC FOR CAUDAL ANESTHESIA

A large number of formulas based on weight, age and number of spinal segments and the parameter 'D' (Distance from C7 to sacral Hiatus) has been used to determine the dose of local anesthetic required.

SPIEGEL et al [12] described a formula to calculate the total volume of injection (V) depending on the distance (D) separating the sacral hiatus from the spinous process of the 7^{th} cervical vertebra as follows

$$V = 4 + \frac{(D-15)}{2}$$

BUSONI et al [13] have published an interesting graph establishing the relationship between volume of the solution, the height of the block and either the age or the weight of the patient.

BROMAGE PR [14] et al proposed a formula to determine the volume of local anesthetics to be injected into the caudal epidural space depending on the age

of the patient and per spinal segment.

V = 0.106 + (0.075 X Age in years)

TAKASAKI M [15] et al suggested a calculation depending on the weight of the patient in kg.

V = 0.056 ml X Body weight (in kg) X number of spinal segments to be blocked .

SCHULTE – STEINBERG examined the statistical influence of age, weight and height on caudal dose requirements before puberty. He found that the pattern of spread to be highly predictable in children. The relationship between age and dose requirement was strictly linear.

V = 0.1 ml / segment / year of age.

V is volume in ml of 1% lignocaine or 0.25% bupivacaine .

In practice, however, it is easier to use the formula described by **ARMITAGE EN et al [16].**

LUMBOSACRAL	0.5 ml/kg
THORACOLUMBAR	1 ml/Kg
MIDTHORACIC	1.25 ml/Kg

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7. Assessment Of Pain

In

Children

7. ASSESSMENT OF PAIN IN CHILDREN

Children present problems of measurement of pain compared with adults because of their lower level of verbal fluency and the likelihood that varied development levels alter their understanding of questions or tests. Hence measurement and assessment of pain proved difficult in children. Assessment and management are interrelated. Only if the pain can be assessed accurately, adequate and appropriate management can follow. Unfortunately no validated totally acceptable tools for measuring pain in children are available. Various methods are available as per **Brown TCK [17]**.

1. Physiological measures
2. Self reporting measures
3. Behavioural measures

PHYSIOLOGICAL MEASURES

Changes in pulse, blood pressure and respiration reflect autonomic arousal. Autonomic responses to pain and their measurement form an important aspect

of certain pain scales. Metabolic changes cause release of catecholamines, growth hormone, glucagon, cortisol, aldosterone and beta-endorphins, which have been

documented in infants and children following noxious stimulation. Only plasma cortisol has been shown to correlate with behavioral responses to noxious stimuli.

SELF REPORTING MEASURES

As described by Manuksela et al **[18]**, these are the best indicators of a child's subjective experience. Various methods have been used:

(a) VISUAL ANALOGUE SCALE

The accepted method of measurement of pain in adults is acceptable and provides reproducible results in children down to an age of five years. VAS using a 10 cm length scale marked "no pain" at one to " worst pain possible " at the other end. The child is asked to identify a point on the scale, which corresponds to his pain. The point is measured from the left hand end and reported in mm from 0 to 100 or in cm from 0 to 10. A score of less than 4 is no pain, less than 6 implies tolerable pain and more than 6 means he needs medication. **[19]**

WONG BAKER FACES SCALE

OUCHER SCALE

It is a variant of the faces scale and is designed to measure pain intensity in children aged 3 to 12 years. The scale is displayed in a poster format. It consists of a vertical numerical scale (0 to 100) on the left and six photographs of children in varying degrees of pain positioned vertically to the right. This scale is based on mimic, vocalization and irritability **[20].** Features characteristics of increasing pain are:

(1) Distortion of face such as lowering of the brow, broadening of the nasal root, angular and squarish mouth, tightly closed eyes and tightening of the jaw.

(2) Vocalization, changing from sobbing or groaning to cry.

(C) WONG – BAKER FACES PAIN RATING SCALE

It is recommended for persons of age three and more. It contains six different faces of expression varying from a happy to sad mood. The patient has to be explained that each face is for a person who feels happy because he has no pain (hurt) or sad because he has some or a lot of pain. Ask the patient to choose the face that best describes how he is

feeling. **[21]**

A similar scale was designed by **Daiva Bieri** et al **[22]** to assess pain in the Children's Hospital, University of Helsinki. This scale was based on mimic, vocalisation, movements or rigidity of the limbs and the body, response to handling and irritability together with the measured cardioventilatory parameters.

BEHAVIOURAL MEASURES

This method of assessment relies on observation of behaviour and is more useful in the pre-school age group of children. They score the behaviours, which represent the reaction to pain and scores are allotted according to the degree of alteration of a particular behaviour .The behaviours scored include vocal behaviours such as cry, scream, verbally expressed pain and anxiety and nonverbal behaviours such as muscle rigidity, torso movements, leg movements, facial expression.

(1) **THE PBRS:** Pain behaviours rating scale and Children's Hospital of Eastern Ontario pain scale - **CHEOPS [23]** are the two such scales. The observation in these scales can have an observer bias.

THE OBJECTIVE PAIN SCALE: This measures pain as a physiological variable, blood pressure along with behavioural changes. This has been shown to be a sensitive and reliable tool in evaluating postoperative pain in children who are not able to verbally comment upon their pain experience. This takes into account the systolic blood pressure, cry and it's response to love and care, movement, agitation and verbal evaluation as described by **Hanallah RS [24].**

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8. Materials And Methods

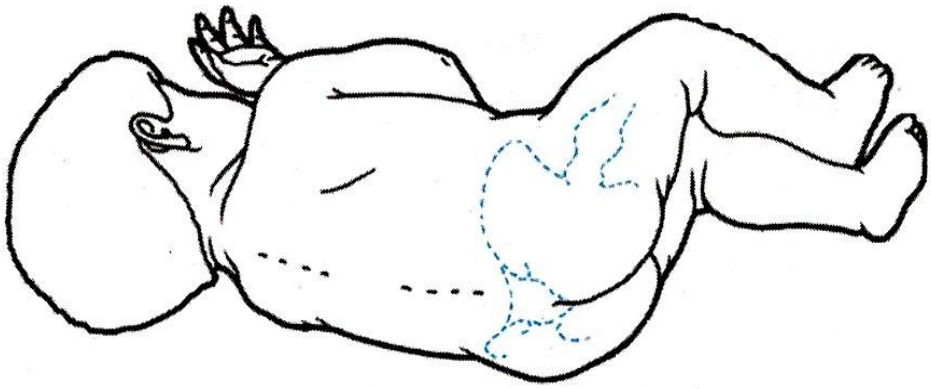
8. MATERIALS AND METHODS

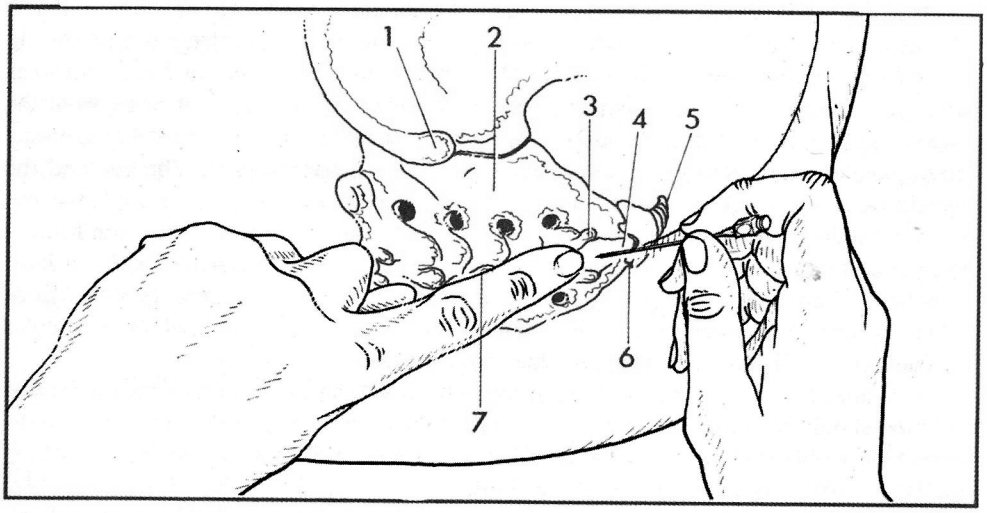
The study population consisted of 70 ASA I and II Children in the age group of 2 years to 8 years admitted to undergo elective lower abdominal general surgical procedure at our hospital. The lower abdominal procedures include herniotomy, PV sac ligation and umbilical herniorhaphy. Exclusion criteria consisted of local infection in the caudal region, bleeding diathesis, preexisting neurological or spinal diseases and congenital anomaly of the lower back. The study was approved by the institutional ethics committee. A written consent was obtained from the parents after they were informed about the procedure to be performed to give postoperative analgesia to their child.

All Children were kept fasting (NPO for 6 hours) and unpremedicated. They were received by the anesthesiologist inside the operating room half an hour before surgery. Thereafter, baseline cardiorespiratory parameters such as pulse rate, systolic blood pressure, ECG, respiratory rate and SPO_2 were recorded and monitored continuously until extubation.

Anesthesia was induced by inhalation of halothane at increasing concentrations in N_2O and oxygen mixture. Intravenous line secured after achieving adequate

CAUDAL BLOCK





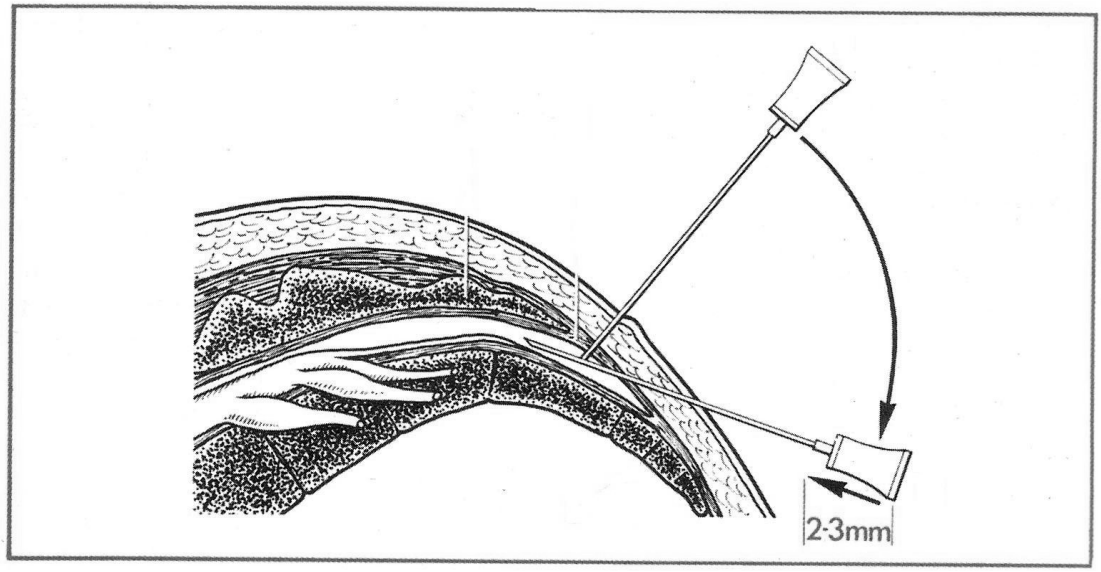
depth of anesthesia. Orotracheal intubation was performed with an appropriate size

uncuffed endotracheal tube. No opioids or benzodiazepines were used intraoperatively. Under controlled ventilation, muscle relaxation was maintained with atracurium 0.5 mg/ kg followed by 0.1 mg/kg as top up doses.

The patients were placed in left lateral position with hips and knees flexed. The children were allocated to receive 0.25% bupivacaine alone (Group B) or 0.25 % bupivacaine with 0.03 mg/kg morphine (Group BM). The dosage of local anesthetic injected into the caudal space was calculated according to the **ARMITAGE** formula. The children undergoing herniotomy and PV sac ligation received a volume of 1 ml/kg in the caudal space. The children undergoing umbilical herniorhaphy received 1.25 ml/kg.

A 22G hypodermic needle was inserted in the hiatus at 45° angle to the skin. Once the sacrococcygeal membrane was penetrated and loss of resistance obtained, the angle of the needle was changed and directed up the canal for further 0.5 cm. The injection was made after gentle aspiration to rule out any intrathecal and intravascular administration. General anesthesia was maintained with 1% halothane and 60% nitrous oxide in 40% oxygen.

CAUDAL BLOCK



the surgical incision was made 20 min after administering caudal block during which time the children were surgically prepared and draped. Adequate caudal analgesia was defined as hemodynamic stability as indicated by absence of increase in heart rate and systolic BP of more than 15% compared with value obtained just before surgical incision with halothane concentration maintained at 1%. If >15% increase occurred analgesia was considered inadequate and rescue opioids were given. These children were excluded from the study. Intraoperative fluid management was taken care by using Holiday and Segar formula.

Postoperatively the Children were shifted to the recovery room for continuous monitoring. The recovery was assessed using **Modified Aldrete Score** (**Table I**) **[25]**. The children were shifted to postoperative ward where monitoring of respiratory rate, SPO_2, pulse rate and systolic blood pressure were continued. The quality of analgesia was assessed hourly for first 6 hours and then every 2 hours. The intensity of pain was measured using the **Objective Pain Scale Score** devised by **Hannallah RS (Table II).** Each parameter was awarded a score of 0-2 accordingly. The sum total of the awarded score was taken at each time interval. A log was kept at the bedside for noting the occurrence of

possible complications including respiratory depression**,** apnea**,** excessive sedation, pruritus, urinary retention or nausea and vomiting.

Patients were administered rescue analgesia with syrup paracetamol 10 mg/Kg on evidence of pain that is if the Objective Pain Scale reached a value of 5. Postoperative sedation score was done using **RAMSAY SCALE** every one hour for first 6 hours and then every 2 hours (**Table III)**.

The time of first analgesia (TFA) was calculated from the time of injection of the drug in the epidural space to the time when OPS reached 5.

Respiratory depression was defined as decrease of SPO_2 < 93% or a decrease in RR < 10 /min. Excessive sedation was defined as a **RAMSAY SEDATION SCORE** of V or VI. Urinary retention was defined as inability to void urine for a period of atleast 8 hours.

TABLE –I MODIFIED ALDRETE'S SCORE

OBSERVATION	CRITERIA	SCORING
Activity	➢ **Able to move all 4 extremities voluntarily or on command** ➢ **Able to move 2 extremities voluntarily or on command** ➢ **Not able to move extremities voluntarily or on command**	**2** **1** **0**
Respiration	➢ **Able to deep breathe and cough freely** ➢ **Dyspnoea or limited breathing** ➢ **Apnoeic**	**2** **1** **0**
Circulation Systolic BP	➢ **± 20 % of Pre-anesthetic level** ➢ **± 20 -50% of Pre-anesthetic level** ➢ **± 50 % of Pre-anesthetic level**	**2** **1** **0**

Consciousness	➢ **Fully awake** ➢ **Arousable** ➢ **Not responding**	**2** **1** **0**
Oxygen saturation	➢ **Able to maintain O_2 saturation > 92% on room air** ➢ **Needs O_2 inhalation to maintain O_2 saturation >90%** ➢ **O2 saturation <90% even with O_2 supplement.**	**2** **1** **0**

-

TABLE -II :OBJECTIVE PAIN SCALE

OBSERVATION	CRITERIA	SCORING
Systolic blood pressure	**± 10 % of Pre-op value** **>20% of Pre-op value** **>30% of Pre-op value**	**0** **1** **2**
Crying	**Not crying** **Crying but responds to TLC *** **Crying not responds to TLC***	**0** **1** **2**
Movement	**None** **Restless** **Thrashing around**	**0** **1** **2**
Agitation	**Asleep or calm** **Mild agitation** **Hysterical**	**0** **1** **2**
Verbalisation of Pain	**Asleep, States no pain** **Vague, Can't localize** **Localize pain**	**0** **1** **2**

*** Tender, Love and care**

TABLE III:

RAMSAY SEDATION SCORE

Six point sedation score was assigned as follows

SCORE	CLINICAL DESCRIPTION
I	**Anxious, Agitated**
II	**Cooperative, Oriented, Tranquil**
III	**Responds only to verbal commands**
IV	**Asleep with brisk response to light stimulation**
V	**Asleep with sluggish response to stimulation**
VI	**Asleep without response to stimulation**

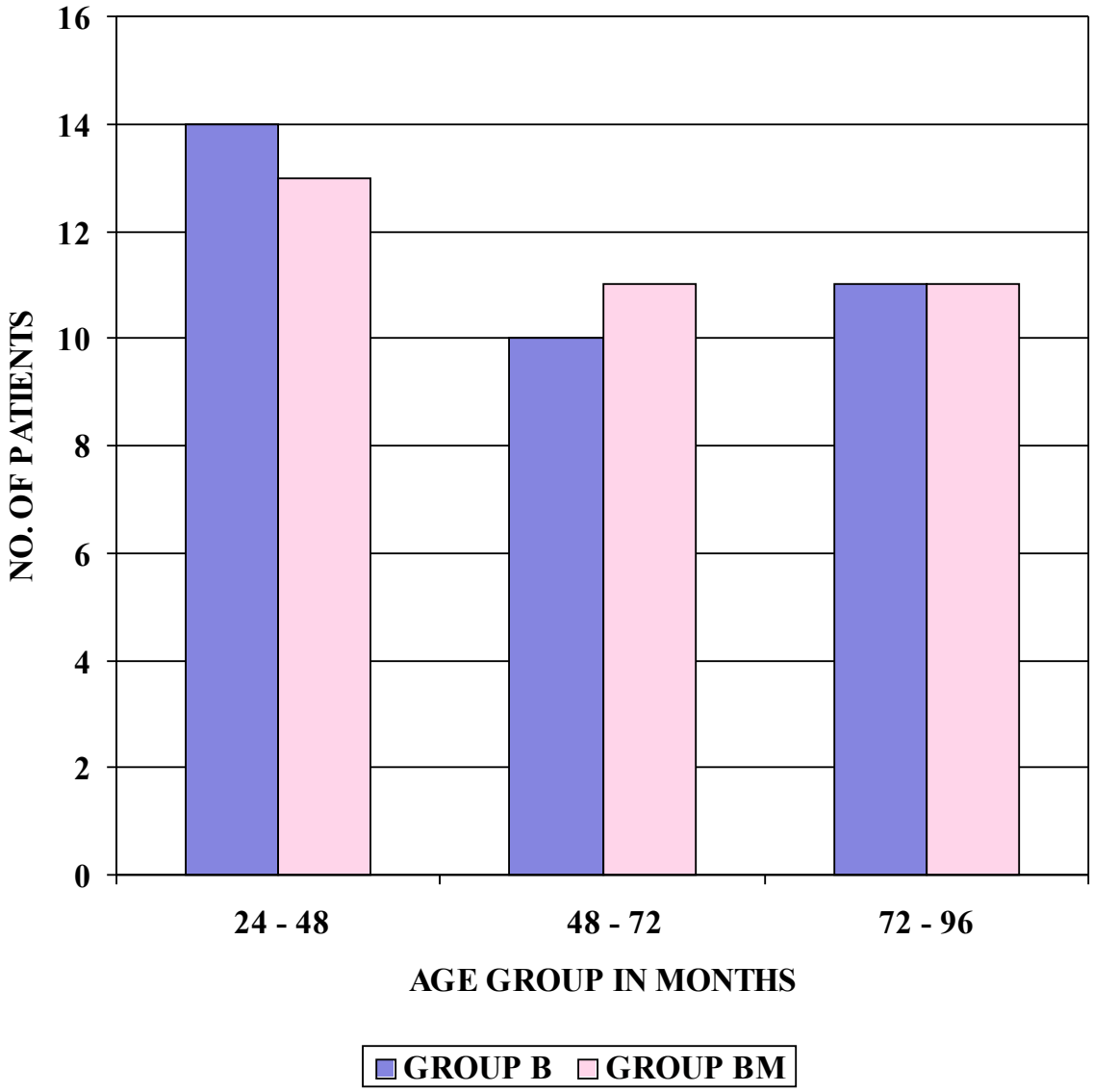
9. Observations

9. OBSERVATIONS

Seventy patients posted for elective lower abdominal general surgical procedure who were admitted in the Department of pediatric surgery, RMH, THANJAVUR MEDICAL COLLEGE of physical status ASA I and II were taken up for the study. They were randomly divided into two groups of 35 patients each to receive caudal block as mentioned below.

One group (group BM) received a mixture of Bupivacaine 0.25% and Morphine at 30 micg/kg, 20 minutes before surgery. Other group (group B) received 0.25% Bupivacaine alone 20 minutes before surgery. The dosage of local anesthetic injected into the caudal space was calculated according to the **ARMITAGE** formula. The children undergoing herniotomy and PV sac ligation received a volume of 1 ml/kg in the caudal space. The children undergoing umbilical herniorhaphy received 1.25 ml/kg. The patients were assessed by a blinded observer in the postoperative period.

AGE DISTRIBUTION

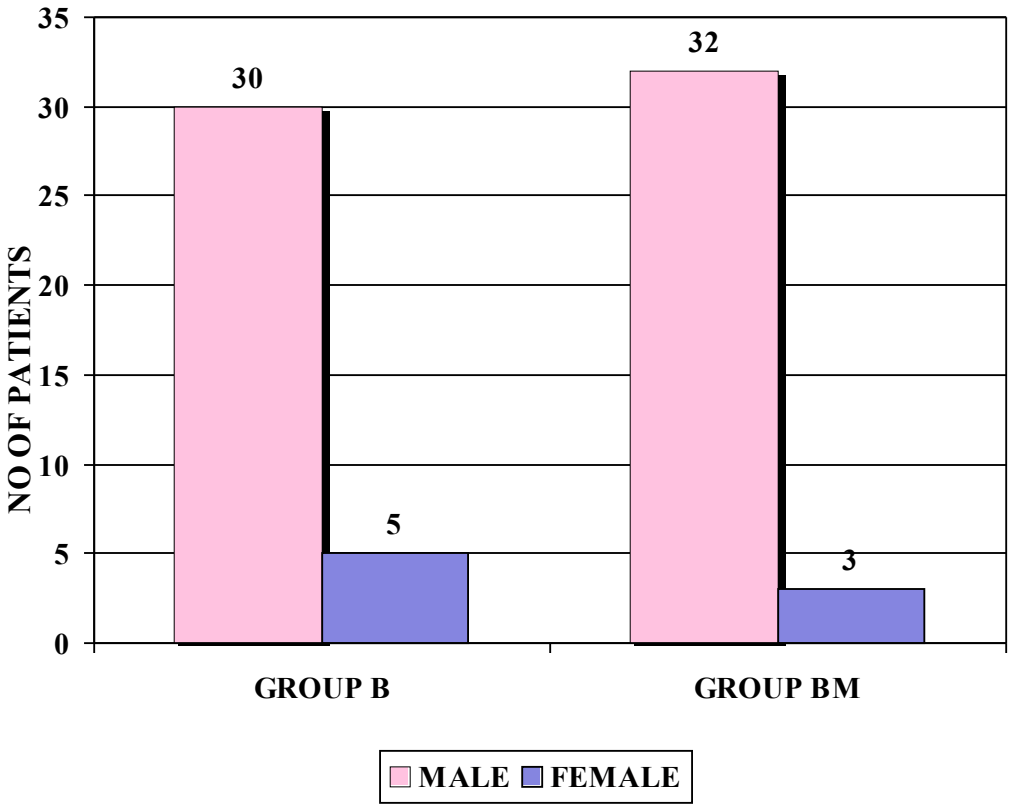


AGE AND SEX DISTRIBUTION

The age distribution in both groups ranged from 2 – 8 years .The age and sex distribution is as follows

AGE IN MONTHS	GROUP B		GROUP BM	
	MALE	FEMALE	MALE	FEMALE
24 – 48 months	12	2	12	1
48 – 72 months	8	2	9	2
72 – 96 months	10	1	11	0
	30	5	32	3

SEX DISTRIBUTION



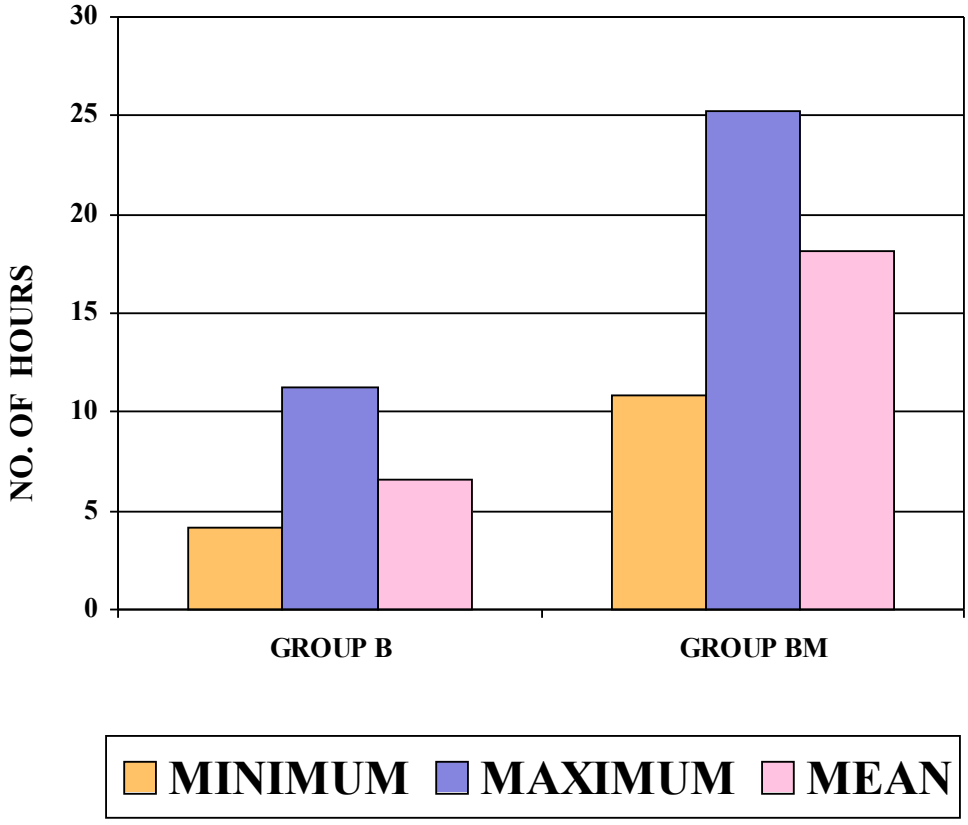
TYPES OF SURGICAL PROCEDURES

The various surgical procedures performed are shown below

SURGICAL PROCEDURES	GROUP B	GROUP BM
Herniotomy	24	21
PV sac ligation	7	9

Umbilical herniorhaphy	**4**	**5**
Total	**35**	**35**

DURATION OF ANALGESIA



DURATION OF ANALGESIA

Duration of analgesia in group B (0.25% bupivacaine) range from 4.2 to 11.6 hours with a mean duration of 6.56 hours. In group BM (0.25 % Bupivacaine + 30 micg/Kg Morphine) the duration of analgesia ranged from 10.8 to 25.2 hours with a mean duration of 18.19 hours.

DURATION OF ANALGESIA	GROUP B	GROUP BM
Range	**4.2 - 11.6**	**10.8 - 25.2**
Mean	**6.56**	**18.19**
Standard Deviation	**1.7034**	**1.7920**

This duration of analgesia is statistically significant as detected by using **Z test** or Large sample test by which the probability value is less than 0.01 (P value < 0.01). This P value means that it is highly significant.

SIDE EFFECTS

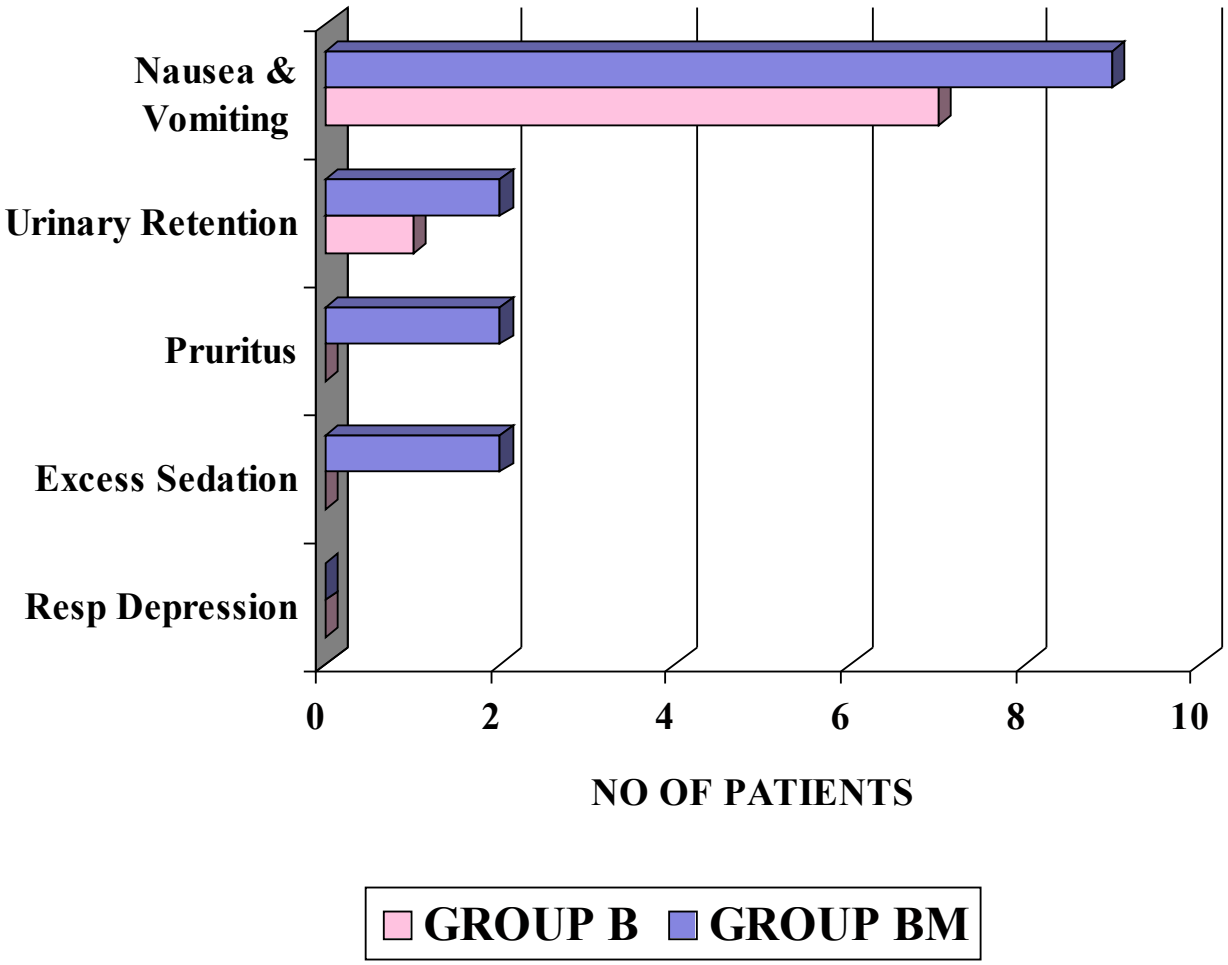
NAUSEA AND VOMITING

Seven patients in group B had nausea and vomiting (17.5%) when compared with nine patients in group BM (22.5 %).

There was no significant difference in the incidence of urinary retention between the two groups.

Two patients (5.5%) in-group BM had nasal pruritus, which settled by itself without any treatment and another two patients had **RAMSAY SEDATION** SCORE scale of V with no evidence of respiratory depression. No serious side effects like respiratory depression or apnea was seen in any patient. Overall side effects did not differ between the two groups.

SIDE EFFECTS



SIDE EFFECTS

Side effects	Group B	Group BM
Nausea and vomiting	7	9
Urinary retention	1	2
Pruritus	0	2
Excessive sedation	0	2
Respiratory depression	0	0

10. Review Of Literature

CAUDAL BLOCKS IN CHILDREN

It is a simple and safe technique, which can be adopted in children. This provides effective intraoperative and postoperative analgesia for almost all types of interventions on the lower part of the abdomen and the lower limbs, especially in the neonates, infants and certain high risk children as per the experience of **ARMITAGE EN [26]** and **ARTHUR DS [27].**

The success rate was found to be 94.5% as per the experience of **ARMANDO FORTUNA [28].**

Caudal anesthesia is usually but not always combined with a light general anesthesia with halothane followed by isoflurane either at the beginning or, sometimes, at the end of surgical procedure. **DALENS B, HASNAOUI A [29].**

The timing of caudal block placement in relation to surgery does not affect duration of post operative analgesia in pediatric ambulatory patients was evidenced by **RICE LJ, PUDIMAT MA, HANALLAH RS [30].**

HANALLAH RS et al **[31]** conducted a study in children in the age group of 18 months to 12 years scheduled for orchiopexy to evaluate the effectiveness of caudal analgesia and compared it with local nerve blocks. They found that both caudal as well as Ilioinguinal / Iliohypogastric nerve blocks administered following inhaled anesthesia for orchiopexy are safe and both are equally effective in controlling post operative pain of children.

JENSEN BH et al [32] conducted a study in 22 children undergoing elective genital operations to evaluate and compare the duration of analgesia following caudal morphine and bupivacaine. They found that the duration of pain relief with morphine (0.1 mg/Kg and 0.5 ml/Kg) was 610 to 2195 minutes (10.16 hours to 36.58 hours) and that with bupivacaine 0.25% and 0.5 ml/Kg was 245 to 515 minutes (4.08 to 8.58 hours). There were no complications of the caudal blocks.

OPTIMUM CONCENTRATION OF BUPIVACAINE FOR CAUDAL ANALGESIA

GUNTER et al [33] conducted a study on 122 children aged 1 to 8 years scheduled for out patient inguinal herniorhaphy who were randomized to receive in a double blind fashion caudal anesthetic with bupivacaine in one of the six concentrations (0.125%, 0.15%, 0.175%, 0.2% and 0.25%). After incision a programmed reduction in inspired halothane resulted, if tolerated by the subject. Although all concentrations were effective

for combined general caudal anesthesia in children, they concluded that 0.175% bupivacaine offers the best combination of effectiveness, rapid recovery and discharge for pediatric surgical outpatients without any motor blockade.

In another study by **WOOLF AR et al [34]** on 114 infants and children of age 6 months to 10 years, undergoing elective superficial lower abdominal or genital surgery to find the optimum concentration of bupivacaine for caudal analgesia, concluded that 0.125% bupivacaine with 1 in 200,000 adrenaline provided equipotent analgesia and significantly less motor blockade than 0.25% bupivacaine.

EPIDURAL MORPHINE IN CHILDREN

KRANE. J et al [35] compared the efficacy, duration and the side effects of preservative free morphine injected into the caudal space in children with caudal bupivacaine and with intravenous morphine for relief of postoperative pain. 46 children aged 1 to 16 years were randomly assigned to receive intravenous morphine, caudal bupivacaine (0.25%, 1 ml/Kg) or caudal morphine (0.5 mg/ml, 0.1 mg/Kg). They found that duration of analgesia was significantly greater with caudal morphine than caudal bupivacaine and both were greater than intravenous morphine. It provided 8 – 24 hours of analgesia without significantly greater incidence of side effects.

MAYHEW et al [36] conducted a study in 500 children to determine the effectiveness

of morphine 0.03 mg/Kg or 0.04 mg/Kg administered caudally for postoperative pain relief. The postoperative pain relief ranged from 6 hours to 24 hours.

COMBINATION OF BUPIVACAINE AND MORPHINE FOR CAUDAL ANALGESIA

WOOLF. AR et al [37] investigated the value of combining morphine with bupivacaine for caudal analgesia. 30 children undergoing orchidopexy received a caudal block with a 0.125% bupivacaine (0.75 ml/Kg) with or without morphine (0.05 mg/Kg). They found that none of the 15 patients receiving the bupivacaine - morphine mixture required postoperative opioids whereas 8 of the 15 patients receiving bupivacaine alone needed additional opioids.

PHARMOCOKINETICS

EPIDURAL MORPHINE IN CHILDREN

ATTIA et al [38] conducted a study on epidural morphine in 20 children ranging in age from 2 to 15 years .The onset and duration was 30 ± 12 minutes and 19.5 ± 8 hours respectively. Sixty minutes after morphine injection the plasma concentration was always less than 12 nanograms / ml. Pharmacokinetic parameters were similar to that of adults but was associated with prolonged respiratory depression that requires close monitoring for at least 24 hours.

ADVERSE EFFECTS OF CAUDAL BLOCKS WITH BUPIVACAINE AND MORPHINE

DALENS et al [39] in their study evaluated the success rate and occurrence of adverse effects as reported in a retrospective study of 750 caudal analgesias in children. Four anesthetic solutions of Ligocaine / Bupivacaine were injected in volumes ranging from 0.5 to 1.25 ml/Kg. The overall success rate was 96%. Most failures occurred in children more than 7 years of age. The incidence of motor blockade is 54% and postoperative vomiting is 12%. There were no major complications or neurological sequelae. There was good parental and patient acceptance of caudal anesthesia.

ATTIA. J et al [40] in their study on epidural morphine (50 micg/Kg) in children observed a decrease in the ventilatory response to CO_2 for the first 10 hours; this decrease may persist for upto 22 hours following administration. This decrease in the ventilatory response to CO_2 is the most sensitive index of respiratory depression.

VALLEY et al [41] in their study on caudal morphine for postoperative analgesia in infants and children observed that the risk of respiratory depression is considerable in infants of less than 1 year old and justifies close monitoring in an intensive care unit.

BUSONI et al [42] did not have a single case of urinary retention in their series of 763

patients following caudal analgesia with local anesthetics.

ELLIOT J KRANE et al [43] in a clinical report of delayed respiratory depression in a child after 3-5 hours of caudal administration of morphine with 0.1 mg/Kg (preservative free) concluded that the risk of delayed respiratory depression is present in children as in adults Though the magnitude of risk and

the period of vulnerability are not defined in children. He also concluded that monitoring of respiratory frequency alone may not be to adequate to detect delayed respiratory depression and that $ETCO_2$ monitoring or pulse oximetry when available may be more reliable early detectors of respiratory depression.

BAILEY et al [44] noted that micturition is delayed to a greater extent after caudal bupivacaine than after caudal diamorphine.

BERNARD DALENS et al [45] quotes that the incidence of undesired side effects was similar in all the studies. Nausea and vomitting occurred in 7.7% to 50%, pruritus occurred in 0 - 57%, urinary retention 12 - 50 % in caudal injections of morphine. In the majority of studies, not a single case of respiratory depression noted.

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11. Discussion

11. DISCUSSION

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This study was a single blinded controlled trial. It was conducted to assess the efficacy of caudal epidural low dose morphine (0.03 mg/kg) with 0.25% bupivacaine for postoperative analgesia and to assess the side effects. Patients were divided into two groups of 35 each. Group BM received 0.25% bupivacaine with morphine 0.03 mg/kg and Group B received 0.25% bupivacaine alone using Armitage formula.

In this study, the addition of low dose morphine 0.03 mg/kg to 0.25% bupivacaine (Group BM) significantly improved the duration of postoperative analgesia.The mean duration of analgesia in the Group BM is 18.19 hours. In Group B the mean duration of analgesia is 6.56 hours. This value is statistically significant as detected by Z Test by which the probability value is less than 0.01 ($P < 0.01$), which means that it is highly significant.

The mean duration of postoperative analgesia in the study Group BM (18.19 hours) correlated well with the study conducted by **MK ARORA [46]** and coworkers which reported a mean duration of 20.8 hours.

The combination of caudal morphine and bupivacaine for relief of postoperative pain after orchiopexy in children was reported by **WOOLF [37]** et al .The bupivacaine morphine group had better quality of analgesia and none of these patients required analgesia in the postoperative period. The concentration of bupivacaine used was 0.125% and morphine 0.05 mg/kg.

The duration of analgesia in Group BM ranged from 10.8 to 25.2 hours. This correlates with the study conducted by **MAYHEW [36]** and coworkers in which the duration of pain relief with low dose caudal morphine 0.03 mg/kg or 0.04 mg /kg ranged from 6 hours to more than 24 hours.

In this study, inspite of using a smaller dose of morphine (0.03 mg/kg), the mean duration of analgesia was 18.19 hours, which could due to synergistic effect of bupivacaine and morphine. **[48]**

SIDE EFFECTS

Caudal morphine may offer analgesic advantage over bupivacaine alone, but the side effects increases in parallel with the dose of morphine. No serious side effect was seen in any of our patient in whom caudal morphine was given.

RESPIRATORY DEPRESSION

Ventilatory monitoring is needed immediately after caudal administration of morphine. The various factors that lead to ventilatory depression include large and repeated doses of extradural morphine, additional opioid or sedative drugs, patients with significant systemic illness, infants and when the drug is delivered in the thoracic epidural region.

There was no incidence of respiratory depression in our study. In concurrence with the above observation **MAYHEW [36]** et al in his study on 500 children, who were administered caudal morphine 0.03 mg/kg or 0.04 mg/kg, did not observe even a single case of respiratory depression

EJ KRANE [35] et al in his study on caudal morphine (0.5 mg/ml, 0.1 mg/kg) in children aged 1 to 16 year did not observe a single case of respiratory depression.

EJ KRANE [43] et al observed a case of delayed respiratory depression in a 2½ year

old child after administration of 0.1 mg/kg of morphine in caudal epidural space which is explained as due to the increased dosage of morphine.

However **KARL et al [47]** reported respiratory depression even after low dose (0.04 mg/Kg) of caudal morphine in a 15-month old child but none of our patients had respiratory depression and the age group studied was between 2 to 8 years.

NAUSEA AND VOMITING

The incidence of nausea and vomiting in Group BM (0.25% bupivacaine and 0.03 mg/kg morphine) was 22.5%. This corresponds to the results obtained by **MAYHEW [36]** et al in his study with low dose caudal morphine (0.03 mg/kg or 0.04 mg/kg). The incidence of nausea and vomiting in his study is 23%.

URINARY RETENTION

In our study, urinary retention was seen in 5.7% patients in Group BM, which correlates with the incidence (7.5%) seen in the study by **MK ARORA [46]** et al. This also correlates with the incidence of urinary retention observed by **MAYHEW [36]** et al.

PRURITUS

Pruritus occurred in two of the 35 patients (5.7 %) in Group BM which corresponds to the wide variations of incidence of pruritus (0 – 57%) in patients receiving caudal morphine as observed by **BERNARD DALENS [45]** et al

Excessive sedation (Ramsay sedation score V) was observed in two patients. They were closely observed for signs of respiratory depression for a period of 24 hours. However, no evidence of respiratory depression was seen.

12.Conclusion

12. CONCLUSION

We conclude that caudal epidural analgesia using a combination of 0.25% Bupivacaine and low dose Morphine 0.03 mg/kg provides better and long lasting postoperative analgesia than 0.25% bupivacaine alone in children undergoing lower abdominal general surgical procedures without any significant increase in side effects.

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14. Proforma

PROFORMA

GROUP B/BM

Name : **Date :**

Age / Sex : **Hospital No :**

Diagnosis : **Weight :**

Surgery done : **Assessment No :**

Duration of surgery :

Preoperative P.R. : **RS :**

Preoperative B.P. : **CVS :**

Preoperative R.R. : **CNS :**

Preoperative SPO_2 :

Time of Caudal block : **Volume of 0.25 % Bupivacaine /**
Time of incision : **0.25 % Bupivacaine + Morphine :**

Time of first analgesic :

PARAMETERS	TIME INTERVAL														
	HOURS														
OPS	1	2	3	4	5	6	8	10	12	14	16	18	20	22	24
a. Crying.															
b. Movements.															
c. Agitation.															
d. Verbalization of pain															
e. Systolic B.P															

TOTAL OPS															

PARAMETERS	TIME INTERVAL																
	MINUTES			HOURS													
	10	20	30	1	2	3	4	5	6	8	10	12	14	16	18	20	22	24
1. Pulse rate																		
2. Respiratory rate.																		
3. Systolic BP																		
4. SPO_2																		
5. Sedation score																		

SIDE EFFECTS: **Nausea and vomiting**

Urinary retention

Pruritus

SUPERVISING ANESTHESIOLOGIST

PROFESSOR OF ANESTHESIOLOGY

THANJAVUR MEDICAL COLLEGE

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15. Master chart

GROUP B

S No	**Name**							PULSE RATE									
		Age	Sex	Wt	IP NO	Surgery	DOS	Pre Op	10 Min	20 Min	30 Min	1	2	3	4	5	6
1	Fargunan	31/2	M	10	992919	Herniotomy	40	98	97	96	95	104	100	100	98	108	114
2	Mahendran	7	M	18	993856	Herniotomy	40	96	98	96	98	92	90	94	108	102	100
3	Yogeswaran	2	M	10	993851	PV sac Lig	30	110	112	108	102	100	104	108	110	104	110
4	Dinesh	6	M	15	994879	Herniotomy	35	100	98	98	104	98	102	108	102	110	112
5	Ajay	4	M	12	994870	Herniotomy	40	92	92	90	90	86	92	90	88	96	102
6	Azhagudurai	3	M	20	994260	Herniotomy	35	90	88	90	86	88	88	92	86	94	100
7	Vignesh	3.5	M	11	995592	Herniotomy	40	98	96	98	96	98	99	96	100	108	112
8	Mathuri	7	FM	18	995893	Herniotomy	40	96	94	92	90	88	94	98	104	106	98
9	Harisriram	3	M	11	995815	PV sac Lig	30	110	110	106	96	98	95	94	100	118	108
10	Vigneswaran	6	M	15	998081	PV sac Lig	30	102	103	100	93	92	92	100	108	112	106
11	Hariharan	2.5	M	10	997984	UmbH'phy	35	112	110	100	100	103	102	108	98	108	106
12	boomika	3	FM	12	998380	Herniotomy	30	108	110	102	101	100	98	98	96	120	110
13	Imrankan	6	M	16	998461	Herniotomy	35	102	100	98	96	94	94	96	106	110	106
14	Ramachandra	2.5	M	10	998673	PV sac Lig	35	114	110	102	104	101	102	106	93	112	120
15	Prem kumar	8	M	12	998480	Herniotomy	40	98	94	88	90	92	88	93	98	96	108
16	Abirami	405	FM	16	999470	Herniotomy	30	102	98	96	94	96	98	98	110	112	100
17	Revathi	11	FM	10	999521	UmbH'phy	35	108	104	102	96	100	114	110	115	118	110
18	vishnu	3	M	11	1000475	Herniotomy	35	104	102	100	98	111	112	110	116	120	120
19	Sakthivel	2	M	9	1000474	Herniotomy	35	112	106	98	98	112	102	110	116	122	122
20	Nitish	4	M	12	1000914	Herniotomy	30	108	102	100	106	108	110	114	118	116	116
21	Sanjay	2.5	M	11	1001678	Herniotomy	30	114	110	98	102	106	108	112	110	110	110
22	Karthick	6.5	M	17	1002148	PV sac Lig	35	102	100	94	96	100	104	108	118	110	110
23	Dananjayan	4	M	13	1002161	Herniotomy	25	110	104	100	110	112	116	118	110	114	14
24	Pari	2.5	M	11	1004840	Herniotomy	30	112	110	102	106	108	110	114	118	122	122
25	Vinoth	7	M	16	1004464	PV sac Lig	35	102	100	98	100	102	104	108	110	112	112
26	Venkadesan	5	M	14	1005767	Herniotomy	40	100	98	96	100	104	106	108	110	106	106
27	Marappan	2	M	10	1005427	Herniotomy	35	106	100	98	104	106	108	110	112	118	118
28	Karthikeyan	8	M	14	1006751	Herniotomy	30	98	94	90	100	104	106	108	110	112	112
29	Thiruppathi	3.5	M	11	1007476	Herniotomy	25	108	102	98	102	104	106	108	110	118	118
30	Prabakaran	6	M	14	1007460	UmbH'phy	35	106	104	99	104	106	108	110	112	118	118
31	Rogan	4	M	13	1008040	PV sac Lig	30	108	104	101	106	108	110	114	116	116	116
32	Venilla	4	FM	12	1008059	Herniotomy	30	104	102	99	96	98	102	104	106	112	112
33	**Ranjith kumar**	4	M	15	1009046	Herniotomy	25	102	100	102	98	100	104	106	108	112	112
34	SathamHussain	4	M	13	1009105	Herniotomy	30	110	108	106	108	110	112	114	116	116	116
35	Nadimuthu	5	M	14	1009066	UmbH'phy	35	108	106	104	108	110	112	114	116	112	112

PULSE RATE									SYSTOLIC BP														
	10	12	14	16	18	20	22	24	Pre Op	10 Min	20	30	1 Hr	2	3	4	5	6	8	10	12	14	116
4	112	110	108	98	110	116	112	114	110	104	103	102	106	104	104	110	112	114	128	125	120	126	120
0	102	104	106	98	100	96	98	100	106	100	100	100	98	103	108	106	114	115	110	112	105	106	102
0	108	109	107	112	100	104	103	102	94	92	91	90	90	92	94	90	98	99	100	98	102	94	97
2	110	112	110	106	108	10	104	105	104	98	99	98	96	100	104	110	106	107	100	102	104	102	102
2	103	106	108	100	98	106	102	104	96	95	97	90	92	92	90	94	94	95	96	98	100	98	103
0	99	102	98	96	98	96	100	98	110	110	106	102	104	100	106	100	105	108	108	114	110	102	114
2	113	115	106	106	104	98	102	100	90	90	84	86	85	87	88	85	92	95	96	95	96	92	93
	99	100	98	97	99	99	100	102	100	99	99	98	95	98	100	104	108	110	104	108	110	112	100
8	106	108	104	106	107	102	102	100	92	92	88	86	87	90	90	86	98	97	108	106	100	98	97
6	104	106	102	104	109	106	100	102	106	102	99	98	99	95	100	108	112	114	107	105	102	101	108
6	108	110	100	104	102	101	105	108	90	88	83	85	85	88	92	99	100	101	95	96	95	92	90
0	108	111	102	100	102	112	111	110	85	88	85	86	85	85	86	86	96	97	92	95	94	88	93
6	107	109	99	96	97	102	106	108	108	100	98	100	96	98	99	106	116	118	110	108	102	95	98
0	119	118	110	106	104	114	112	116	84	85	83	80	83	84	83	82	90	92	98	100	92	84	92
8	107	110	112	108	110	102	103	104	110	102	100	102	100	98	99	102	100	101	116	114	118	115	108
0	99	98	99	96	94	96	98	98	98	97	99	92	94	100	104	106	104	105	102	105	108	106	104
0	112	111	98	96	100	96	98	98	88	92	90	90	92	90	94	93	98	99	104	102	100	98	96
6	117	116	100	97	100	96	95	97	87	94	92	90	90	87	86	91	97	98	99	101	100	95	95
6	114	118	112	98	96	98	98	96	80	90	90	84	85	85	86	90	92	94	95	97	96	94	96
0	112	108	106	102	100	102	102	98	100	106	104	102	104	106	108	110	111	112	112	111	112	108	104
8	109	114	104	100	101	100	103	98	82	88	90	84	85	88	90	92	90	91	90	88	90	86	85
8	110	112	106	100	104	100	100	102	102	108	106	103	105	106	108	110	108	110	108	107	91	100	102
0	112	114	110	106	105	106	106	108	97	106	105	100	103	105	108	110	109	110	109	108	110	104	108
2	119	116	116	118	119	118	117	115	85	98	98	92	94	97	98	100	102	104	102	101	89	96	95
0	111	106	100	104	105	104	105	107	106	106	104	102	105	106	108	110	108	109	108	107	105	100	98
2	104	100	100	98	100	98	99	96	102	105	104	100	102	104	108	110	108	109	108	105	106	102	100
0	117	118	110	114	113	114	113	112	88	100.	99	96	98	101	103	106	108	110	108	105	98	105	107
0	112	102	104	106	109	106	107	108	108	112	111	108	110	112	114	118	116	118	116	114	105	116	118
0	118	116	112	116	117	116	112	110	94	99	96	96	97	98	100	102	103	105	103	110	103	104	106
6	117	114	111	110	112	110	113	106	101	107	105	102	104	105	107	110	112	111	112	116	107	107	110
4	115	110	106	110	108	110	108	110	92	98	98	93	96	97	98	100	102	104	102	100	112	103	104
4	110	112	105	110	107	110	104	108	90	103	100	98	101	104	105	107	110	111	110	111	107	109	110
0	108	112	110	106	110	106	105	108	100	108	105	103	104	107	108	110	112	114	112	108	107	106	108
4	117	106	109	110	108	110	108	108	102	106	104	100	102	104	105	108	107	108	107	105	107	106	102
0	108	105	104	104	105	104	105	106	98	104	100	101	102	103	105	107	105	103	102	101	104	104	101

				OP SCALE														T F A	Respiratory rate				
18	20	22	24	1 Hr	2	3	4	5	6	8	10	12	14	16	18	20	22	24	Pre Op	1 Hr	2	3	4

11	12	11	11	0	0	0	1	2	4	4	2	2	3	2	1	2	1	2	7.2	30	30	2	3	26
4	0	8	5	0	0	0	2	2	3	4	3	2	2	3	2	2	1	3	8.4	24	25	8	5	22
11	10	10	10	0	0	1	3	4	5	4	2	2	2	1	3	2	1	2	5.4	32	26	2	2	27
0	2	4	3	0	0	2	4	3	2	1	2	3	2	3	1	1	2	2	4.3	26	20	6	5	29
94	97	96	95	0	0	1	1	1	3	4	2	2	1	1	2	3	2	4	8.5	28	21	2	2	22
10	10	10	10	0	0	0	0	0	1	2	4	4	1	1	2	1	2	3	11.	24	20	4	5	24
0	2	2	1	0	0	0	1	2	4	2	2	1	1	1	2	3	1	4	6	32	24	2	2	26
97	10	10	99	0	0	2	4	3	3	2	1	3	1	3	2	3	1	3	6.5	27	24	1	0	30
10	3	0	10	0	0	0	0	1	2	4	2	3	1	2	1	1	2	4	4.6	28	23	2	2	21
8	11	11	8	0	0	2	3	4	4	3	1	2	1	1	1	3	2	3	8.1	25	21	0	0	28
96	4	0	99	0	0	2	4	3	3	2	1	2	1	1	1	1	2	2	5.8	30	24	2	2	35
10	93	98	10	0	0	0	1	2	4	2	1	2	1	2	2	2	1	1	4.2	30	24	3	2	27
3	10	10	1	0	0	0	1	3	4	2	1	1	1	2	2	1	2	2	6.1	25	23	2	2	27
95	0	2	98	0	0	0	0	2	2	4	3	1	1	1	2	2	1	2	6.5	29	25	4	4	28
10	97	10	10	0	0	0	0	0	0	3	4	2	1	1	1	1	2	2	7.4	23	19	2	2	20
5	10	0	8	0	0	0	2	5	2	2	1	2	2	1	1	1	2	2	9.3	26	20	5	8	24
96	8	11	97	0	0	2	4	4	2	1	1	2	1	2	1	1	1	2	5.0	29	19	2	2	28
90	90	0	97	0	0	0	0	0	2	4	2	1	1	1	2	1	2	1	4.2	24	23	0	1	26
10	93	98	99	0	0	0	1	1	3	4	3	2	1	1	1	2	1	2	8.2	31	23	2	2	32
6	98	96	99	0	0	0	2	2	4	2	1	2	1	1	2	1	1	1	7.6	26	23	2	5	28
94	92	98	10	0	0	0	5	4	1	1	2	1	2	1	2	1	1	1	6.1	28	27	2	2	32
11	10	98	2	0	0	0	2	4	2	1	1	1	1	1	2	2	2	1	4.0	24	23	2	3	28
0	8	11	10	0	0	3	4	2	1	1	1	1	2	2	1	2	2	1	5.2	28	28	2	2	30
10	10	0	7	0	0	0	0	2	4	2	2	2	1	1	2	1	1	2	3.6	30	25	6	7	30
2	4	10	10	0	0	0	2	5	3	1	1	2	1	1	1	2	2	2	6.5	24	25	2	2	31
95	96	5	0	0	0	2	4	3	2	2	2	3	2	3	1	2	1	1	4.9	25	25	3	4	29
95	95	99	99	0	0	0	0	1	1	4	3	2	1	2	1	1	1	1	4.1	29	26	2	2	32
92	96	97	10	0	0	0	2	4	4	1	2	1	2	1	2	1	2	1	8.5	23	23	6	6	28
10	10	98	0	0	0	0	0	0	0	2	2	4	2	1	1	1	2	1	5.8	28	27	2	1	30
6	4	10	10	0	0	0	0	0	3	4	2	2	1	1	1	1	1	2	11.	25	27	0	9	30
85	85	6	4	0	0	0	1	3	4	1	1	1	1	1	1	2	2	1	6	24	26	2	2	29
96	10	90	88	0	0	0	0	1	1	4	2	2	1	1	2	2	1	1	7.6	25	23	1	2	27
10	2	10	10	0	0	0	1	1	4	2	1	2	1	1	1	2	1	2	6.1	26	26	2	2	30
9	10	0	2	0	0	0	3	5	2	1	1	1	2	1	2	1	2	2	8.6	24	25	3	4	29
94	8	10	10	0	0	0	2	4	2	1	1	1	1	2	1	2	1	1	6.2	25	27	2	2	30
10	95	6	4																4.8			6	6	
2	98	96	98																5.2			2	2	
10	10	10	98																			6	8	
4	0	0	10																			2	2	
10	10	10	5																			4	7	
2	7	2	10																			2	3	
11	11	10	5																			8	0	
4	8	8	11																			2	2	
10	10	11	7																			5	7	

Respiratory rate												Side effects				
5	6	8	10	12	14	16	18	20	22	24	Vomiting	Urinary Retention	Pruritus	Resp Depression	Max sedation Score
2	2	3	3	3	3	3	31	28	28	30	0	Nil	Nil	Nil	3
8	8	2	1	0	1	2	25	24	24	22	0	Nil	Nil	Nil	3
2	2	2	2	2	2	2	32	30	29	28	+	Nil	Nil	Nil	2
6	8	6	5	5	4	6	27	26	25	24	+	Nil	Nil	Nil	4
3	2	3	2	2	2	3	25	26	25	24	0	Nil	Nil	Nil	3
4	8	0	8	7	8	2	21	24	28	26	0	Nil	Nil	Nil	3
2	2	2	2	2	2	2	28	27	30	32	0	Nil	Nil	Nil	2
8	6	6	5	5	7	7	31	26	26	24	0	Nil	Nil	Nil	4
2	2	2	2	2	2	2	32	22	24	25	0	Nil	Nil	Nil	2
5	4	8	8	9	7	5	23	24	25	25	+	Nil	Nil	Nil	3
2	2	2	2	2	2	2	24	25	29	28	0	Nil	Nil	Nil	3
0	2	6	9	8	6	2	25	29	30	29	0	Nil	Nil	Nil	3
3	3	3	3	3	2	2	22	24	27	27	0	Nil	Nil	Nil	3
0	2	2	1	0	9	9	25	29	32	34	0	Nil	Nil	Nil	3
3	3	2	2	2	2	3	22	25	28	27	0	+	Nil	Nil	4
2	0	6	7	8	7	2	22	21	26	26	+	Nil	Nil	Nil	3
2	2	3	3	2	2	3	21	28	27	28	0	Nil	Nil	Nil	3
4	6	1	0	8	9	2	25	24	26	25	0	Nil	Nil	Nil	3
2	2	2	2	2	2	2	23	25	32	30	0	Nil	Nil	Nil	3
8	8	6	7	3	2	3	25	24	26	24	0	Nil	Nil	Nil	3
3	3	3	2	3	2	2	25	24	28	26	0	Nil	Nil	Nil	4
4	4	0	9	0	9	5	24	21	22	24	0	Nil	Nil	Nil	2
3	3	3	3	3	3	2	24	21	26	28	0	Nil	Nil	Nil	3
4	6	0	1	2	0	6	27	25	24	28	+	Nil	Nil	Nil	4
2	3	2	2	2	2	2	25	23	26	26	0	Nil	Nil	Nil	3
9	0	8	7	6	7	2	22	21	24	25	0	Nil	Nil	Nil	3
3	3	3	3	2	2	2	32	30	29	28	+	Nil	Nil	Nil	3
0	2	7	1	8	4	5	21	21	22	24	0	Nil	Nil	Nil	4
2	2	2	2	3	2	2	34	33	26	26	0	Nil	Nil	Nil	2
0	4	8	9	0	8	2	24	26	25	26	0	Nil	Nil	Nil	2
3	2	2	2	2	2	2	25	24	25	24	0	Nil	Nil	Nil	3
2	8	6	5	5	4	3	27	27	28	26	0	Nil	Nil	Nil	2
2	2	3	2	2	2	2	27	26	26	25	0	Nil	Nil	Nil	3
4	6	0	7	3	2	1	23	22	27	25	+	Nil	Nil	Nil	2
2	3	2	2	2	2	2	24	23	28	26	0	Nil	Nil	Nil	3
8	0	8	7	8	7	6									
3	3	3	3	3	2	2									
3	6	4	2	0	3	5									
2	3	2	2	2	2	2									
8	0	8	7	7	6	5									

3	3	3	2	2	2	2										
0	1	0	9	7	7	6										
3	2	2	2	2	2	2										
2	7	6	5	4	4	3										
3	2	2	2	2	2	2										
0	9	8	7	6	5	5										
3	3	3	3	3	2	2										
2	5	4	2	0	9	8										
3	3	2	2	2	2	2										
4	0	8	6	7	6	5										
2	2	2	2	2	2	2										
8	7	6	5	3	1	2										
3	3	3	3	3	3	3										
2	5	7	5	5	3	2										
2	2	2	2	2	2	2										
7	7	6	5	4	3	2										
3	3	3	3	3	3	3										
0	2	5	6	7	6	5										
3	3	3	3	2	2	2										
0	2	1	0	9	7	7										
2	3	2	2	2	2	2										
8	0	8	6	7	5	5										
2	2	3	3	3	2	2										
7	9	1	0	0	8	8										
3	3	3	2	2	2	2										
2	2	1	9	8	8	7										
3	2	2	2	2	2	2										
1	8	7	6	5	5	4										
3	2	2	2	2	2	2										
3	9	8	7	7	7	5										

GROUP BM

S No	**Name**							PULSE RATE								
		Age	Sex	Wt	IP NO	Surgery	DOS	Pre Op	10 Min	20 Min	30 Min	1	2	3	4	5	6

1	Jagadish	5	M	10	992915	Herniotomy	40	10	97	96	98	9	9	88	86	88	90
2	Balaji	7	M	18	992916	PV sac Lig	40	4	98	96	90	6	0	88	90	90	92
3	Sriram	4	M	10	992290	Herniotomy	30	10	106	104	90	8	8	98	98	97	99
4	Paulraj	21/2	M	15	994303	Herniotomy	35	0	110	108	90	4	2	97	10	10	112
5	Kokila	6	FM	12	994304	Umb H’	40	10	98	95	90	8	8	89	0	1	94
6	Satishkumar	7	M	20	994382	phy	35	8	102	100	94	4	6	86	92	94	101
7	Ranjitha	3	FM	11	994879	PV sac Lig	40	11	106	99	97	8	8	82	97	96	97
8	Parthiban	3	M	18	995855	Herniotomy	40	2	111	106	90	4	8	84	86	88	98
9	Chanavas	21/2	M	11	996304	Herniotomy	30	98	110	107	98	8	8	96	82	88	112
10	Durgabarathi	5	FM	15	996987	Umb H’	30	10	107	103	94	4	7	87	10	10	100
11	Naveen	6	M	10	996959	phy	35	2	106	100	94	8	8	82	8	0	87
12	Sivaperumal	31/2	M	12	996937	Herniotomy	30	10	102	100	90	1	2	87	98	99	107
13	Prabakaran	41/2	M	16	997433	Herniotomy	35	8	100	98	92	9	9	84	84	88	99
14	Raja	5	M	10	997434	Umb H’	35	11	104	98	92	6	4	84	98	99	98
15	Veeramani	6	M	12	998025	phy	40	0	98	99	90	9	8	98	98	10	107
16	Madhavi	3	FM	16	998524	Herniotomy	30	11	98	95	92	6	7	86	87	0	105
17	Arun	41/2	M	10	998475	PV sac Lig	35	2	102	98	90	8	8	87	10	86	102
18	Rajkumar	3	M	11	998520	Herniotomy	35	10	108	92	90	6	4	97	3	10	107
19	Kavimani	21/2	M	9	998974	Herniotomy	35	6	106	94	90	8	8	92	98	5	103
20	Praveenkumar	7	M	12	999489	PV sac Lig	30	10	110	93	90	1	2	97	98	98	107
21	Baskaran	5	M	11	999480	Herniotomy	30	4	110	99	94	9	9	10	10	99	109
22	Ajay	5	M	17	999992	Umb H’	35	10	100	96	92	7	8	2	3	10	110
23	Vadivelan	6	M	13	100004	phy	25	8	98	95	91	9	8	10	97	0	102
24	Karthick	31/2	M	11	7	Herniotomy	30	10	92	96	92	3	4	1	10	10	91
25	Varatharajan	5	M	16	100047	PV sac Lig	35	6	94	95	91	9	8	92	2	2	108
26	Gowrisankar	5	FM	14	3	Herniotomy	30	10	92	94	92	4	7	83	10	10	98
27	Clinton	41/2	M	10	100047	Herniotomy	35	6	94	99	91	9	8	10	7	1	97
28	Karthick	7	M	14	7	PV sac Lig	30	10	90	93	92	7	1	7	10	99	99
29	Tamizvanan	8	M	11	100091	Herniotomy	25	2	88	88	91	8	8	86	7	10	98
30	Divakar	21/2	M	14	7	Herniotomy	35	10	106	106	90	5	7	87	98	2	112
31	Praveen	7	M	13	100167	PV sac Lig	30	5	100	99	92	9	8	87	87	10	98
32	Abishek	3	M	12	5	Herniotomy	40	10	102	92	97	7	2	84	10	0	107
33	Kathiresan	8	M	15	100168	Herniotomy	25	7	100	93	92	8	8	96	7	88	104
34	Madan	21/2	M	13	6	Herniotomy	30	11	102	97	97	1	4	87	92	10	107
35	Arun	31/2	M	14	100212	PV sac Lig	35	2	98	97	91	8	9	86	87	2	102
					7	Herniotomy		11				7	2	97	92	94	
					100212	Umb H’		0				8	8	88	87	82	
					9	phy		11				4	8	91	10	94	
					100350	Herniotomy		4				8	9		7	90	
					7	PV sac Lig		10				6	1		92	10	
					100332			6				8	9		97	3	
					7			10				7	8		10	97	
					100745			8				8	9		2	10	
					4			10				7	4		94	0	

PULSE RATE									SYSTOLIC BP														
S	10 hrs	12	14	16	18	20	22	24	Pre Op	10 Min	20	30	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	8 hrs	10 hrs	12 hrs	14 hrs	16 hrs

	98	10	10	11	11	12	11	110	10	103	10	10	10	10	10	98	98	96	98	10	10	10	114
	10	3	6	4	6	1	2	98	4	108	0	0	2	2	0	99	10	10	10	0	1	8	120
0	0	10	11	10	10	10	10	91	11	104	98	10	98	10	10	10	0	4	2	11	11	11	106
9	10	7	0	2	0	1	0	115	2	93	10	0	90	0	2	5	10	10	11	0	8	6	112
	2	11	11	11	10	10	90	107	10	102	2	98	98	92	94	94	4	2	2	11	11	11	114
3	12	3	5	2	8	0	11	110	6	100	90	94	92	10	10	10	96	98	10	0	2	8	112
1	0	12	12	13	12	11	2	116	96	92	10	10	10	0	6	7	10	10	3	10	10	10	102
2	10	3	7	1	8	9	10	119	10	92	0	0	2	99	96	98	6	4	11	2	7	8	112
3	0	10	10	10	10	11	2	115	6	88	98	98	10	94	10	90	99	10	0	11	11	11	115
1	10	1	4	5	9	2	10	109	10	92	92	94	1	10	2	95	92	2	10	0	0	0	107
	5	10	11	11	10	10	9	113	2	96	93	93	10	1	10	98	96	92	6	10	11	11	108
8	10	7	6	2	5	9	11	105	96	88	90	90	3	10	0	92	10	98	94	4	2	6	104
8	6	10	10	10	11	11	8	111	98	94	90	92	95	5	94	91	0	10	10	94	96	98	116
2	10	7	8	9	2	9	12	114	92	98	94	96	10	97	10	93	94	4	2	10	10	10	110
7	0	10	11	11	11	12	0	105	96	99	92	94	2	10	2	98	93	95	10	0	8	6	120
9	11	9	0	5	8	1	11	109	98	96	92	98	10	3	90	97	92	93	8	10	11	10	115
9	4	11	11	11	11	12	2	115	92	94	96	96	1	10	96	10	10	95	98	4	0	8	116
3	10	5	5	6	7	1	10	125	10	96	94	10	10	2	92	0	0	10	96	98	10	10	110
7	2	10	10	10	10	11	2	.	0	90	94	0	0	10	90	98	99	2	96	96	2	0	102
0	10	3	4	7	9	5	11	117	10	92	90	98	94	0	98	94	10	98	10	94	10	10	102
9	0	10	10	10	10	10	6	113	2	100	92	10	10	92	97	10	0	10	6	10	5	2	118
0	10	2	0	9	2	9	10	102	10	100	92	0	0	90	95	0	98	5	10	4	10	10	116
7	5	10	10	11	10	10	3	102	6	102	90	94	94	96	98	98	92	10	0	98	0	0	118
	10	8	6	5	1	7	10	115	10	98	98	92	10	92	97	98	10	2	10	10	11	11	110
9	7	10	11	11	12	11	5	117	0	99	92	93	2	91	95	99	0	10	8	6	0	0	114
1	10	9	1	4	0	7	11	103	10	100	10	10	10	10	92	98	96	3	10	10	10	10	108
	5	10	10	10	11	11	2	119	2	99	0	0	6	0	10	97	98	98	6	4	6	4	112
	10	7	5	9	5	9	10	111	98	102	96	10	10	10	2	10	99	92	10	10	11	12	112
	7	10	11	11	10	10	2	105	94	110	92	0	4	7	90	7	97	98	8	4	6	0	131
7	10	9	6	6	0	7	11	102	96	92	10	10	10	88	93	90	97	10	10	10	11	11	105
3	5	10	11	11	11	11	4	128	10	92	0	2	5	88	95	92	10	2	2	0	2	0	106
9	11	9	2	7	2	5	11	121	3	93	96	99	98	86	97	92	5	10	96	96	11	11	108
4	0	11	11	11	12	12	0	109	10	100	97	98	88	10	84	11	90	4	10	98	0	4	106
2	11	3	2	4	0	5	12	109	2	86	10	96	92	2	10	0	92	10	0	10	10	10	100
7	4	11	11	11	11	11	2	107	10	98	0	10	10	98	4	86	90	2	10	6	5	8	103
	10	5	5	6	4	8	12	107	8		98	0	5	98	85	90	10	98	8	10	98	98	
	8	11	11	11	11	12	0		10		90	10	10	82	85	96	8	11	10	7	10	10	
	11	2	4	9	7	1	11		3		92	0	5	82	86	10	88	0	9	10	4	2	
	0	11	11	11	12	12	4		10		10	10	92	94	84	6	92	98	10	5	11	11	
	11	1	2	5	4	4	10		3		0	8	94	10	84	86	98	98	7	10	6	8	
	0	11	11	11	10	10	5		10		88	92	97	1	90	98	10	97	10	0	11	11	
	11	1	6	7	1	8	10		2		10	94	99	82	85	94	6	11	2	11	3	8	
	2	11	12	10	10	10	5		10		0	98	98	84	92		88	6	11	5	11	11	
	10	3	0	9	2	7	11		4			10	90	90			10	92	6	94	2	0	
	5	10	10	10	11	12	2		10			2	98	96			0	95	96	98	10	10	

				OP SCORE														TFA	Respiratory rate			
18	20	22	24	1 hr	2	3	4	5	6	8	10	12	14	16	18	20	22	24	1 hr	2	3	4

108	110	10	11	0	0	0	0	0	0	0	1	1	1	4	2	2	1	1	16.	1	18	20	19
116	118	8	2	0	0	0	0	0	0	1	1	4	1	2	1	1	1	1	4	8	17	15	16
100	104	11	10	0	0	0	0	0	0	1	1	2	4	2	1	2	1	1	12.	1	18	18	19
105	.	0	6	0	0	0	0	0	0	1	1	2	2	4	2	2	1	0	8	6	20	20	23
105	112	10	10	0	0	0	0	0	0	0	1	1	1	2	3	4	2	0	14.	1	18	19	18
105	119	2	2	0	0	0	0	0	0	1	1	3	5	4	2	2	2	0	2	9	17	17	18
99	110	10	10	0	0	0	0	0	0	0	1	1	1	3	3	4	3	2	16.	2	19	18	18
102	106	5	8	0	0	0	0	0	0	0	1	1	1	1	2	3	3	5	2	1	19	18	19
105	106	11	10	0	0	0	0	0	0	1	1	2	2	4	3	2	3	1	19.	1	20	20	21
104	110	5	6	0	0	0	0	0	0	0	1	1	1	2	3	4	2	1	5	8	17	18	19
108	110	10	11	0	0	0	0	0	0	0	1	1	1	2	2	4	5	3	14.	1	19	20	19
106	112	8	0	0	0	0	0	0	0	0	1	3	1	2	4	2	5	2	0	9	19	19	20
110	106	10	10	0	0	0	0	0	0	0	1	3	2	4	3	2	1	1	21	2	20	19	21
112	115	5	2	0	0	0	0	0	0	1	1	1	2	3	2	5	3	2	23.	0	18	18	19
115	114	11	12	0	0	0	0	0	0	1	1	2	4	2	2	2	1	1	8	1	16	16	18
105	119	0	0	0	0	0	0	0	0	1	1	2	3	4	2	2	1	1	16.	9	20	19	22
108	110	10	11	0	0	0	0	0	1	0	1	1	1	2	3	4	2	3	8	2	18	18	21
106	108	8	0	0	0	0	0	0	1	0	1	1	1	2	2	3	5	1	19.	2	21	20	20
105	108	10	10	0	0	0	0	0	0	0	1	1	1	2	2	4	2	1	4	1	21	21	20
104	110	5	5	0	0	0	0	0	0	1	1	1	2	3	4	2	1	1	22.	7	25	25	26
108	108	10	11	0	0	0	0	0	0	1	1	2	4	2	2	2	1	1	0	1	25	27	27
112	110	8	2	0	0	0	0	0	0	2	1	3	3	3	1	1	1	0	17.	9	23	23	24
120	116	11	10	0	0	0	0	0	0	0	1	1	2	3	3	4	2	2	8	2	20	21	23
106	122	2	6	0	0	0	0	0	0	0	1	1	2	3	2	4	5	2	16.	0	20	20	21
98	108	11	11	0	0	0	0	0	0	4	1	3	4	2	2	1	1	2	2	2	24	25	25
105	104	2	2	0	0	0	0	0	0	0	1	1	1	3	1	3	2	4	20.	0	24	21	21
110	110	11	11	0	0	0	0	0	0	1	1	1	1	2	2	3	4	2	0	2	24	27	27
120	112	4	5	0	0	0	0	0	0	0	1	1	1	2	4	3	2	1	14.	0	21	25	25
120	124	11	11	0	0	0	0	0	0	0	1	2	2	4	3	3		1	7	1	19	20	20
102	126	6	6	0	0	0	0	0	0	0	1	1	5	2	3	3	4	2	16.	7	21	24	24
105	102	10	10	0	0	0	0	0	0	0	1	0	4	1	2	2	2	5	3	2	23	24	24
95	110	2	5	0	0	0	0	0	0	1	1	3	4	3	2	2	1	1	19.	2	21	27	27
101	100	10	10	0	0	0	0	0	0	1	1	3	2	4	2	2	1	1	4	1	19	22	22
102	106	6	8	0	0	0	0	0	0	0	1	2	2	3	4	3	2	1	22.	9	19	25	25
110	106	11	10	0	0	0	0	0	0	0	1	1	1	1	2	4	2	2	0	2	21	25	25
	112	4	8																20.	1			
		10	10																3	2			
		2	5																17.	3			
		10	10																5	2			
		4	6																14.	4			
		10	11																8	2			
		5	0																13.	2			
		11	11																5	2			
		4	0																19.	1			
		12	12																5	2			

Respiratory rate											Side effects				
5	6	8	10	12	14	16	18	20	22	24	Vomiting	Urinary Retention	Pruritus	Resp Depression	Max sedation Score
20	21	20	2	2	2	3	30	26	25	26	0	0	0	Nil	3
18	16	18	2	4	5	0	25	21	22	22	+	0	0	Nil	3
18	20	21	1	2	2	2	26	26	25	26	0	0	0	Nil	3
20	22	21	9	3	4	4	32	30	30	28	0	0	0	Nil	3
18	20	21	2	2	2	2	24	30	32	28	+	+	0	Nil	4
19	20	19	0	1	4	9	26	26	28	26	0	0	0	Nil	3
18	17	18	2	2	2	3	25	29	28	28	0	0	0	Nil	3
18	20	20	1	3	8	3	25	28	25	30	0	0	0	Nil	4
20	22	20	2	2	2	2	30	32	28	30	+	0	0	Nil	3
19	18	20	1	0	2	4	25	29	26	28	+	0	0	Nil	3
20	21	20	1	2	2	2	23	25	26	26	0	0	0	Nil	4
19	20	21	9	3	4	5	28	28	27	29	0	0	+	Nil	5
18	21	22	1	1	2	2	30	30	28	29	0	0	0	Nil	3
18	18	21	8	9	0	0	26	28	27	27	0	0	0	Nil	3
17	17	20	2	2	2	2	20	26	25	24	+	0	0	Nil	3
20	21	20	0	1	2	6	28	28	27	29	0	0	0	Nil	4
19	21	22	2	2	2	3	26	28	26	28	0	0	0	Nil	4
20	22	21	0	4	8	2	24	32	30	26	+	0	+	Nil	3
20	22	21	2	2	2	2	26	32	30	29	0	0	0	Nil	5
22	27	29	1	2	3	4	30	29	28	29	0	0	0	Nil	3
23	28	30	2	2	2	2	30	31	30	27	0	0	0	Nil	3
25	27	27	0	1	1	1	29	29	28	24	+	0	0	Nil	3
20	23	24	2	2	2	2	28	29	27	29	0	0	0	Nil	5
21	24	25	1	3	4	7	28	29	27	28	0	0	0	Nil	4
22	27	29	2	2	2	3	26	27	26	28	0	0	0	Nil	3
22	25	25	2	6	5	3	28	30	28	32	+	0	0	Nil	4
23	29	30	2	2	2	2	30	31	29	31	0	0	0	Nil	3
26	27	27	1	0	2	4	28	27	30	28	0	0	0	Nil	3
20	21	24	2	2	2	2	26	31	30	29	0	0	0	Nil	3
20	24	27	0	2	2	2	28	30	29	25	0	0	0	Nil	3
22	25	27	2	2	2	2	28	27	26	28	+	+	0	Nil	4
22	27	29	1	5	6	9	29	27	26	27	0	0	0	Nil	4
23	22	24	2	2	2	2	28	32	30	29	0	0	0	Nil	3
22	27	29	2	3	4	5	30	31	30	29	0	0	0	Nil	4
24	27	29	2	2	2	2	30	30	29	30	0	0	0	Nil	4
			0	0	1	4									
			1	2	2	2									
			9	4	3	8									
			2	3	3	3									
			8	1	3	2									

			2	3	3	3									
			9	1	2	1									
			2	2	3	3									
			8	9	0	1									
			2	2	2	2									
			3	4	5	7									
			2	2	2	3									
			5	7	8	0									
			2	3	3	2									
			8	1	1	7									
			2	2	2	2									
			4	5	6	7									
			2	3	3	3									
			9	1	2	2									
			2	2	3	2									
			8	9	0	9									
			2	2	2	2									
			5	7	8	8									
			2	2	2	2									
			6	7	8	9									
			2	2	3	2									
			6	8	0	8									
			2	3	3	3									
			8	1	0	0									
			2	2	2	2									
			4	4	6	7									
			2	2	2	3									
			8	9	8	2									
			2	3	3	3									
			9	1	0	2									